R & D facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Hydrogen Research

12/2006

Reciprocating Engine Laboratory

Capabilities

The National Energy Technology Laboratory's (NETL's) Reciprocating Engine Laboratory provides a versatile facility for detailed engine performance investigation which may be suitably studied using a single cylinder engine. The prime mover is a Ricardo Proteus engine, which may be configured for diesel or spark ignition (SI) operation, equipped with a DC dynamometer, which may be operated as a brake or motor. General specifications of the engine are as follows:

- Number of cylinders: 1
- Bore: 130.2 mm (5.1 in)
- Stroke: 150.0 mm (5.9 in)
- Swept volume: 1.997 liters (122.4 in3)
- Rated speed: 36.7 rps (2202 rpm)
- Compression ratio
  - 13.3:1 (DI build)
  - 16.6:1 (IDI build)
- Maximum intermittent output
  - 55 kW (73.7 HP) (DI build)
  - 25.5 kW (33.9 HP) (IDI build)
- Maximum boost pressure ratio: 3.0

The engine is instrumented with high and low speed computer data acquisition systems that record all major engine parameters. A gas sample train allows the measurement of oxygen, total hydrocarbons, carbon dioxide, carbon monoxide, and nitrous oxide concentrations in the exhaust, while a dilution tunnel is used to measure particulate emissions. Ignition timing in SI operation is computer controlled and variable over a wide range. Currently, the engine may be fueled by natural gas or hydrogen or any mixture of the two. The engine has also been operated with diesel fuel and coal-water slurry.

CONTACTS

John Ontko, P.E.
Reciprocating Engine Group Leader
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4930
john.ontko@netl.doe.gov

Diane (DeeDee) Newlon
Technology Transfer Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4086
rdiane.newlon@netl.doe.gov

ADDRESS

National Energy Technology Laboratory

1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

2175 University Avenue South
Suite 201
Fairbanks, AK 99709
907-452-2559

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

One West Third Street, Suite 1400
Tulsa, OK 74103-3519
918-699-2000

CUSTOMER SERVICE

1-800-553-7681

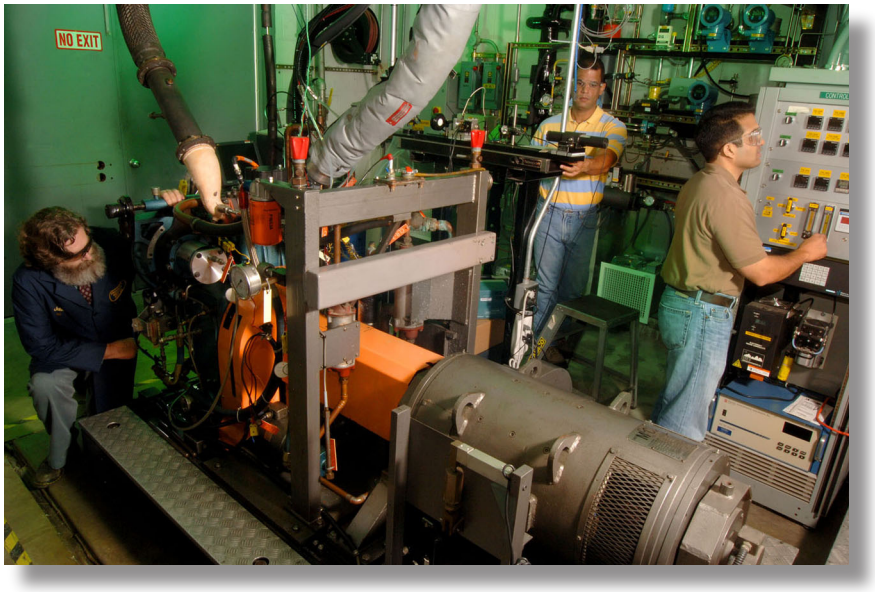
WEBSITE

www.netl.doe.gov

Current Research

As part of a University Research Initiative, NETL is collaborating with West Virginia University researchers to investigate the effect of lubricating oil on emissions and performance characteristics of a hydrogen fueled engine. The objectives of this study are as follows:

1) Evaluate the oil consumption as a function of equivalence ratios, engine speed, spark timing, and the onset of knock.
2) Evaluate regulated and unregulated emissions (such as toxic lube-oil derived heavy organics and nanoparticles) and combustion characteristics under different operating conditions.
3) Determine particle size distribution in both combustion modes and motoring (no fueling) modes using a Scanning Mobility Particle Sizer.
4) Assess degradation of lubricating oil possibly due to hydrogenation in the presence of oil-derived metals that could act as catalysts.
5) Assess the impact of lube oil derived pollutants on emission control systems, which will be necessary for meeting not only the stringent 2007/2010 emissions standards, but also for elimination of Environmental Protection Agency and California Air Resources Board defined Toxic Air Contaminants.



Researchers in the Office of Research and Development's Reciprocating Engine Laboratory at the Department of Energy's National Energy Technology Laboratory prepare NETL's Ricardo Proteus engine for hydrogen-fueled test operation. Shown from left to right are NETL Reciprocating Engine Group Leader John Ontko, and West Virginia University PhD candidates Jacinto Solano and Sam George. The research project is part of a University Research Initiative in which NETL strengthens its research capability by teaming with researchers from regional universities.